



PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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| Applicant's or agent's file reference 000054016 | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/EP2003/011929 | International filing date (day/month/year) 28 October 2003 (28.10.2003) | Priority date (day/month/year) 30 October 2002 (30.10.2002) |
| International Patent Classification (IPC) or national classification and IPC C07C 11/02 | | |
| Applicant BASF AKTIENGESELLSCHAFT | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 8 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☒ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

| | |
|--|---|
| Date of submission of the demand 10 May 2004 (10.05.2004) | Date of completion of this report 18 May 2005 (18.05.2005) |
| Name and mailing address of the IPEA/EP | Authorized officer |
| Facsimile No. | Telephone No. |

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/EP2003/011929

I. Basis of the report

1. With regard to the elements of the international application:*

- ☐ the international application as originally filed
- ☒ the description:
 pages 1-11, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____
- ☒ the claims:
 pages 1-9, as originally filed
 pages _____, as amended (together with any statement under Article 19
 pages _____, filed with the demand
 pages _____, filed with the letter of _____
- ☐ the drawings:
 pages _____, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
 pages _____, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

- These elements were available or furnished to this Authority in the following language _____ which is:
- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rule 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Box IV.3

The International Searching Authority has found that the international application contains multiple (groups of) inventions, as follows:

1. Claims 1 to 6 (in part) and 7 to 9
Process for producing oligomers as per claim 1, steps (a) and (b).
2. Claims 1 to 6 (in part)
Process for producing methyl-*tert*-butyl ether, isovaleraldehyde, polyisobutylene, 2,4,4-trimethyl-1-pentene or saturated hydrocarbon compounds with 8 carbon atoms, as per claim 1, steps (a) and (c1) to (c5).

The application is found to address the following problems, which form the basis of the invention:

1. (See in particular page 1, lines 5 to 9)

The aim is to provide an alternative process for producing oligomers, consisting mainly of repeating units, derived from 1-butene or 2-butene, from a hydrocarbon flow consisting essentially of branched and linear hydrocarbon compounds with 4 carbon atoms, containing olefinic branched and linear hydrocarbon compounds with 4 carbon atoms.

2. (See page 1, lines 25 to 39)

The aim is to provide an alternative process for producing methyl-*tert*-butyl ether (step (c1)),

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Box IV.3

isovaleraldehyde (step (c2)), polyisobutylene (step (c3)), 2,4,4-trimethyl-1-pentene (step (c4)) or saturated hydrocarbon compounds with 8 carbon atoms (step (c5)), consisting mainly of repeating units, derived from branched hydrocarbon compounds with 4 carbon atoms, from a hydrocarbon flow consisting essentially of branched and linear hydrocarbon compounds with 4 carbon atoms, containing olefinic branched and linear hydrocarbon compounds with 4 carbon atoms.

The only technical feature that links the two processes is step (a) in claim 1. This step is already known from the prior art document D1 (US-A-6 440 885, column 7, line 61, and column 8, line 33).

Although claim 1 states that the process is a "coupled process", the following points should be stressed:

The requirement of unity of invention is met when there is a technical relationship between the claimed inventions involving one or more of the same or corresponding special technical features. "Special technical features" are technical features which establish a contribution made by each of the inventions as a whole over the prior art (PCT Article 17(3) and PCT Rule 13.1 and 13.2). The decision whether the inventions are so linked as to form a single general inventive concept must be made without regard to whether the inventions are claimed in separate claims or as alternatives within a single claim (PCT Rule 13.3)).

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Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Box IV.3

In this instance the only "feature" (if it can be regarded as such) that could be considered a "special technical feature" is the fact that the two processes are "coupled". However, "coupled" does not mean that steps (b) and (c) are a one-pot reaction, nor does it mean that steps (b) and (c) have to be carried out at precisely the same time. Therefore in this case it makes no sense to specify whether or not the two processes are "coupled".

Hence there is no single general novel concept. Regarding the lack of further technical features that could be considered "special technical features" (PCT Rule 13.2), the International Searching Authority concludes that the two claimed inventions in the present application are not linked by a single general inventive concept (PCT Rule 13.1).

There is thus a lack of unity of invention, and the subject matter of the two different inventions, which should normally be linked by a common inventive concept, has been set out above (PCT Article 17(3)(a)).

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V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|--------|-----|-----|
| Novelty (N) | Claims | 1-9 | YES |
| | Claims | | NO |
| Inventive step (IS) | Claims | | YES |
| | Claims | 1-9 | NO |
| Industrial applicability (IA) | Claims | 1-9 | YES |
| | Claims | | NO |

2. Citations and explanations

Reference is made to the following documents:

- D1: US-B1-6 440 885 (PIEROTTI KIM D et al.), 27 August 2002 (2002-08-27)
- D2: WO 01/37989 A (BASF AG; WALTER MARC (DE); HEIDEMANN THOMAS (DE)), 31 May 2001 (2001-05-31)
- D3: EP-A-0 405 781 (CHEMICAL RES & LICENSIN), 2 January 1991 (1991-01-02)
- D4: GB 690 149 A (BASF AG), 15 April 1953 (1953-04-15)
- D5: US-A-5 910 550 (RATH HANS PETER), 8 June 1999 (1999-06-08)
- D6: WO 01/46095 A (DAKKA JIHAD M; GEELEN MARC (BE); MATHYS GEORGES M K (BE); ALLEN PAUL), 28 June 2001 (2001-06-28)
- D7: US 2002/087040 A1 (DI GIROLAMO MARCO et al.), 4 July 2002 (2002-07-04)

Invention 1

Novelty (PCT Article 33(2))

Document D1 discloses a zeolite membrane (claim 1) and the use thereof for separating linear and branched hydrocarbon compounds with 4 carbon atoms (column 7, line 61, and column 8, line 33). There is no mention of subsequent oligomerisation

of the linear olefinic hydrocarbon compounds. The subject matter of claims 1 to 9 is therefore novel over D1.

Document D2 discloses (page 3, lines 9 to 32, and table 3) oligomerisation of butene using a nickel catalyst. There is no mention of a membrane for separating linear and branched hydrocarbon compounds with 4 carbon atoms. The subject matter of claims 1 to 9 is therefore novel over D2.

Inventive step (PCT Article 33(3))

Document D2 is considered to be the prior art closest to the subject matter of claims 1 to 9 because it discloses the production of the products specified in the present application (oligomers of linear C₄ olefinic hydrocarbon compounds). The only difference between D2 and the process according to claims 1 to 9 of the present application is in the source of the starting product (linear C₄ olefins), which is not mentioned in D2. Linear C₄ olefins can be obtained in various ways that are known from the prior art, including the separation process as described in D1. The use of a known source of the starting product in a process for producing oligomers that is also known *per se* cannot be considered inventive. The subject matter of claims 1 to 9 therefore fails to meet the requirement of PCT Article 33(3).

Invention 2

Novelty (PCT Article 33(2))

Steps (c1) to (c5) of claim 1 represent, *per se*, a process that is well known in the art.

Document D1 discloses a zeolite membrane (claim 1) and the use thereof for separating linear and branched hydrocarbon compounds with 4 carbon atoms (column 7, line 61, and column 8, line 33). There is no mention of subsequent oligomerisation

of the branched olefinic hydrocarbon compounds as per steps (c1) to (c5) in the present application. The subject matter of claims 1 to 9 is therefore novel over D1.

Document D3 discloses (as mentioned in the present application, page 10, lines 11 to 12) step (c1) of the present invention, namely the production of MTBE by a reaction between isobutene and methanol (see D1, page 3, lines 36 to 49, and example 1). There is no mention of a membrane for separating linear and branched hydrocarbon compounds with 4 carbon atoms. The subject matter of claims 1 to 9 is therefore novel over D3.

Document D4 discloses step (c2) of the present invention, namely hydroformylation of MTBE (see the example in D4). There is no mention of a membrane for separating linear and branched hydrocarbon compounds with 4 carbon atoms. The subject matter of claims 1 to 9 is therefore novel over D4.

Document D5 discloses step (c3) of the present invention, namely polymerisation of isobutene to polyisobutylene (see D5, claim 1). There is no mention of a membrane for separating linear and branched hydrocarbon compounds with 4 carbon atoms. The subject matter of claims 1 to 9 is therefore novel over D5.

Document D6 discloses step (c4) of the present invention, namely dimerisation of isobutene to 2,4,4-trimethylpentene (see D6, claim 1). There is no mention of a membrane for separating linear and branched hydrocarbon compounds with 4 carbon atoms. The subject matter of claims 1 to 9 is therefore novel over D6.

Document D7 discloses step (c5) of the present invention, namely alkylation of isobutene with the formation of saturated hydrocarbon compounds with 8 carbon atoms (see D7,

paragraph 15). There is no mention of a membrane for separating linear and branched hydrocarbon compounds with 4 carbon atoms. The subject matter of claims 1 to 9 is therefore novel over D7.

Inventive step (PCT Article 33(3))

Invention 2 in the present application actually involves five different processes, as follows:

1. (a) and (c1)
2. (a) and (c2)
3. (a) and (c3)
4. (a) and (c4)
5. (a) and (c5)

Regarding (a) and (c1):

Document D3 is considered to be the prior art closest to the subject matter of claims 1 to 9 because it discloses the production of the products specified in the present application (MTBE). The only difference between D3 and the process according to claims 1 to 9 of the present application is in the source of the starting product (branched C₄ olefins), which is not mentioned in D3. Branched C₄ olefins can be obtained in various ways that are known from the prior art, including the separation process as described in D1. The use of a known source of the starting product in a process for producing oligomers that is also known *per se* cannot be considered inventive. The subject matter of claims 1 to 9 therefore fails to meet the requirement of PCT Article 33(3).

The same assessment also applies to the other processes listed above (processes 2 to 5) in comparison with documents D1 and D4 to D7 respectively. The subject matter of claims 1 to 9 therefore fails to meet the requirement of PCT Article 33(3).